

April 8, 1950

Deep Rock Oil Corporation
Tulsa, Oklahoma

Attention: Mr. T. F. Lawry

Gentlemen:

Enclosed herewith is the report of the analysis made on the 2 $\frac{1}{8}$ inch rotary core taken from the Brunjes # 3 Lease, Core Test Well No. 1, Crawford County, Kansas, and submitted to our laboratory on March 30, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:dt
c.c. to Mr. Neil Henderson

DEEP ROCK OIL CORPORATION

CORE ANALYSIS REPORT

BRUNJES # 3 LEASE

CORE TEST WELL NO. 1

CRAWFORD COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

APRIL 8, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Deep Rock Oil Corporation Lease Brunjes # 3 Core Test Well No. 1

Location 330 ft. west of east line, 990 ft. north of south line, NE $\frac{1}{4}$,

Section 23 Twp. 28S Rge. 22E County Crawford State Kansas

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Name of Sand Bartlesville

Top of Core 375.75

Bottom of Core 390.05

Top of Sand ?

pay
Bottom of Sand 384.10

Total Feet of Permeable Sand 6.56

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	1.80	1.80
10 - 20	3.91	5.71
20 - 30	0.85	6.56

Average Permeability, Millidarcys 13.15

Average Percent Porosity 17.91

Average Percent Oil Saturation 42.91

Average Percent Water Saturation 34.87

Average Oil Content, Bbls./A. Ft. 595.

Total Oil Content, Bbls./Acre 4,269.

Average Percent Oil Recovery by Laboratory Flooding Tests 7.75

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 109.

Aotal Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 741.

Total Calculated Oil Recovery, Bbls./Acre 2,050.

Packer Setting, Feet 375.00

Viscosity, Centipoises @ 67° 34.4

A. P. I. Gravity, degrees @ 60 °F 28.6

Note: The above averages are for that part of the sand section extending from the packer setting to the top of the cement plug.

Fresh water was used as a circulating fluid in the coring of the sand in this well. According to the cuttings, approximately $1\frac{1}{2}$ feet of sand was drilled before coring was started. There was approximately 55 gallons of oil in the core hole before coring was started. We were advised that this well was drilled in virgin territory.

FORMATION CORER

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
375.75 - 376.17	- Brown fine grained micaceous sandstone.
376.17 - 377.60	- Laminated sandy shale.
377.60 - 378.25	- Brown fine grained laminated micaceous sandstone.
378.25 - 380.15	- Dark brown fine grained micaceous sandstone.
380.15 - 380.76	- Brown fine grained micaceous sandstone.
380.76 - 380.95	- Brown fine grained laminated micaceous sandstone.
380.95 - 381.65	- Brown fine grained micaceous sandstone.
381.65 - 382.80	- Dark brown fine grained micaceous sandstone.
382.80 - 382.95	- Dark fine grained micaceous finely laminated carbonaceous sandstone.
382.95 - 384.10	- Brown fine grained micaceous sandstone.
384.10 - 384.63	- Dark fine grained micaceous carbonaceous shaley sandstone.
384.63 - 386.25	- Gray shale.
386.25 - 390.05	- Discarded at well.

Coring was started at a depth of 375.75 feet in fine grained micaceous sandstone and completed at 390.05 feet in shale. This core shows a total of 7.45 feet of sand. For the most part, the sand body is made up of fine grained micaceous sandstone.

PERMEABILITY

The sand in this core is tight; having an overall weighted average permeability of only 13.15 millidarcys (See Table II). By observing the data given on the coregraph, you will note that the sand section has a fairly uniform permeability profile.

PERCENT SATURATION & OIL CONTENT

The weighted average percent oil saturation of the pay sand or that part of the sand section extending from the top of the core to the cement plug is 42.91 percent; while the average percent water saturation is 34.87 (See Table IV). This gives an overall weighted average total fluid saturation of 77.78 percent. This comparatively low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil.

In order to get some idea of the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. From the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur during coring. However we are inclined to believe that most of the oil lost was due to the expansion of gas carried in solution by the oil.

VISCOSITY

The viscosity of a sample of crude oil taken from a producing well on the north end of this leases is 34.4 centipoises at 67° F. The A.P.I. gravity of the oil is 28.6° at 60° F. The viscosity of this oil is comparatively high for the depth of the formation and the permeability of the sand.

LABORATORY FLOODING TESTS

The sand in this core responded only fairly well to laboratory flooding tests as a total recovery of 741 barrels of oil per acre was obtained from 6.77 feet of sand. The weighted average percent oil saturation was reduced from 43.72 to 35.97, or represents an average recovery of 7.75 percent. The weighted average effective permeability of the samples is 0.248 millidarcys while the average initial fluid production pressure is 35 pounds per square inch (See Table V). By observing the data given above, it is noticeable that the sand samples after flooding have a high residual oil saturation.

From the data given in Table V, you will note that of the 8 samples tested, 7 produced oil and took water. This would indicate that most of the sand represented by these samples is floodable, however, it is apt to require fairly high pressures in order to force this sand to take the required amount of water.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 2,050 barrels of oil per acre provided the sand will take water satisfactorily. In calculating this recovery, an allowance was made for oil lost during coring and it was assumed that the true water saturation of the sand is 34 percent and that the well was drilled in virgin territory.

The principle drawback of this core is the fact that the sand has a low permeability for its depth and contains a comparatively viscous oil. Furthermore, the core shows only 6.77 feet of floodable sand.

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SHOT RECOMMENDATION

Company Deep Rock Oil Corporation Lease Brunjes # 3 Core Test No. 1

<u>Depth Interval, Feet</u>	<u>Feet of Sand</u>	<u>Size of Shell Inches</u>	<u>Qts./Ft.</u>	<u>Total Quarts</u>
379.00 - 383.00	4.0	4 $\frac{1}{2}$	3.1	12.4

Recommended Packer Setting - 375.0 feet
Note: Plug hole back to - 384.50 feet

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RESULTS OF PERMEABILITY TESTS
TABLE I

Company Deep Rock Oil Corporation Lease Brunies # 3 Core Test Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	376.70	Imp.	0.60	0.60	0.00
2	377.54	Imp.	0.50	1.10	0.00
3	378.10	11.	0.65	1.75	7.15
4	378.60	27.	0.65	2.40	17.55
5	379.31	14.	0.50	2.90	7.00
6	379.55	17.	0.75	3.65	12.75
7	380.24	2.8	0.25	3.90	0.70
8	380.60	16.	0.36	4.26	5.76
9	381.03	4.3	0.70	4.96	3.01
10	381.72	25.	0.20	5.16	5.00
11	381.96	15.	0.45	5.61	6.75
12	382.75	10.	0.50	6.11	5.00
13	382.90	Imp.	0.15	6.26	0.00
14	383.11	5.4	0.45	6.71	2.43
15	383.75	17.	0.70	7.41	11.90
16	384.16	3.1	0.53	7.94	1.64

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company <u>Deep Rock Oil Corporation</u>		Lease <u>Brunjes # 3</u>	Core Test <u>Well No. 1</u>
Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
375.75 - 384.50	6.56	13.15	86.24

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RESULTS OF SATURATION TESTS

TABLE III

Company Deep Rock Oil Corporation Lease Brunjes # 3 Core Test Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1	375.92	17.8	46.7	29.5	76.2	645	0.42	0.42	271
2	377.83	18.5	36.2	36.3	72.5	520	0.65	1.07	338
3	378.82	18.6	47.6	25.9	73.5	687	1.15	2.22	790
4	380.00	18.8	37.2	40.8	78.0	543	0.75	2.97	407
5	381.25	17.8	48.2	28.1	76.3	665	1.50	4.47	997
6	382.42	17.9	39.8	37.7	77.5	553	1.15	5.62	636
7	383.34	17.3	40.7	44.8	85.5	546	1.15	6.77	627
8	384.32	15.4	42.6	41.6	84.2	508	0.53	7.30	269
							Total		4,335

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SUMMARY OF SATURATION TESTS

TABLE IV

Company	Deep Rock Oil Corporation	Lease	Brunjes # 3	Core Test	Well No. 1	
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
375.75-384.50	7.17	17.91	42.91	34.87	595	4,269

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Deep Rock Oil Corporation Lease Brunson # 3 Core Test Well No. 1

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability, Millidarcys	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	376.09	18.3	43.9	624	6.0	88	37.9	54.7	539	3	0.091	45
2	377.69	16.8	38.4	501	5.3	69	33.1	66.7	432	3.5	0.135	40
3	379.08	18.2	50.1	708	8.3	117	41.8	52.0	591	17	0.432	25
4	379.72	19.2	40.5	603	8.8	131	31.7	60.4	472	11	0.259	30
5	381.54	19.0	42.8	632	7.6	112	35.2	53.6	520	5.5	0.138	40
6	382.15	16.6	44.9	580	6.8	88	38.1	57.4	492	11	0.264	30
7	383.60	18.2	41.4	599	9.7	137	32.7	56.9	462	8	0.208	35
8	384.52	14.9	44.1	510	0.0	0	44.1	29.3	510	0	Imp.	50+

Notes: cc - cubic centimeter
*Volume of water recovered at the time of maximum oil recovery.
**Determined by passing water through sample which still contains residual oil.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company	Deep Rock Oil Corporation	Lease	Brunjes # 3	Core Test	Well No. 1
Depth Interval, Feet	375.75 - 384.10				
Feet of Core Analyzed	6.77				
Average Percent Porosity	18.08				
Average Percent Original Oil Saturation	43.72				
Average Percent Oil Recovery	7.75				
Average Percent Residual Oil Saturation	35.97				
Average Percent Residual Water Saturation	56.62				
Average Percent Total Residual Fluid Saturation	92.59				
Average Original Oil Content, Bbls./A. Ft.	614.				
Average Oil Recovery, Bbls./A. Ft.	109.				
Average Residual Oil Content, Bbls./A. Ft.	505.				
Total Original Oil Content, Bbls./Acre	4,160.				
Total Oil Recovery, Bbls./Acre	741.				
Total Residual Oil Content, Bbls./Acre	3,419.				
Average Effective Permeability, Millidarcys	0.248				
Average Initial Fluid Production Pressure, p.s.i.	35.0				

NOTE: Only those samples which recovered oil were used in calculating the above averages.

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RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company Deep Rock Oil Corporation Lease Brunjes # 3 Core Test Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate	Percent Water Saturation Drilling & Foreign	Total
1	375.92	13,350			
2	377.83	17,550			
3	378.82	10,050			
4	380.00	11,050			
5	381.25	15,700			
6	382.42	12,700			
7	383.34	14,200			
8	384.32	13,700			
Note: ppm - parts per million.					

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company	Deep Rock Oil Corporation	Lease	Brunjes # 3	Core Test	Well No. 1
Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water		
375.75-384.50	13,500				

Note: ppm - parts per million.